REMARKS/ARGUMENTS

Claims 1 to 20 are currently pending in this application. Claims 1, 4 and 20 have been amended with this response. No new matter has been added with these amendments. Claims 6, 7, 11 and 16 have been canceled and claims 21 to 36 have been withdrawn.

Affirmation of Election

Applicants hereby affirm the verbal election of the invention listed as "Group 1" by the Examiner (claims 1 to 20). Accordingly, Applicants have hereby withdrawn claims 21 to 36 (Group II) from consideration in this application.

Rejections Under 35 U.S.C. §112

The Examiner rejected claims 1, 4 and 6 as indefinite for the use of the term "around". Applicants have amended the claims to eliminate the term "around", thereby obviating this rejection.

The Examiner also rejected claim 16 as indefinite based on the use of the term "conventional dental material." Applicants have cancelled claim 16, thereby obviating this rejection.

Rejections Under 35 U.S.C. §102(e)

The Examiner rejected pending claims 1 to 8, 14 and 15 as anticipated under 35 U.S.C. §102(e) over Horton et al. (US Patent Pub. No. 2002/0162605). Applicants respectfully traverse this rejection.

Applicants have amended claim 1, the sole independent claim to include the limitation of claim 11, which the Examiner acknowledges is not disclosed by the Horton

et al. reference. Accordingly, Applicants submit that the amended claims cannot be said to be anticipated by the Horton et al. publication.

Rejections Under 35 U.S.C. §103(a)

The Examiner also rejected the remaining pending claims as unpatentable under 35 U.S.C. §103(a) over Horton et al., either alone, or in view of one of the following additional references: Lin et al. (USPN 5,735,975) and WIPO Publication No. 00/68469. Applicants respectfully traverse these rejections.

The Horton et al. Reference

The current invention is directed to a dental prosthesis, which "replicates" at least a portion of the surface of a tooth using an amorphous metal. More specifically, the current invention is directed to a dental prosthesis made with those bulk amorphous materials having specific physical properties, namely, those alloys that allow for the replication and maintenance of the highly intricate shapes and surface features of a tooth. Specifically, Applicants have discovered that a subset of bulk solidifying amorphous alloys having high elastic limits, high hardness, low coefficients of thermal expansion and low glass transition temperatures provide for the production of substantially improved dental prostheses. The importance of these properties is summarized by Applicants as follows:

> [0034] Secondly, bulk solidifying amorphous alloys can be readily cast from the molten state to replicate the very details of impression prepared for dental prosthesis. Indeed, Applicants have discovered that the low melting temperatures of bulk-solidifying amorphous alloys provide a relatively easier casting operation such as reduced or minimal reaction with molds or investment shells. Further, the lack of any first-order phase transformation during the solidification of the bulk solidifying amorphous alloy reduces solidification shrinkage and as such provides a near-to-net shape configuration of the metallic dental prosthesis. The solidification shrinkage is then dominated by the coefficient of thermal expansion rather than the volume difference between the solid and liquid state of the casting alloy. *Accordingly, bulk amorphous alloys with low coefficient*

thermal expansion (at temperatures from ambient to glass transition) are preferred. For example, Zr-base bulk solidifying amorphous alloys have generally a coefficient of thermal expansion of around 10^{-5} (m/m °C.) providing low shrinkage rates. This is extremely important in the production of metallic dental prostheses since many of the intricate portions of the impressions can be lost if significant post-cast processing is required. In addition, bulk-solidifying amorphous alloys keep their fluidity to exceptionally low temperatures, such as down to the glass transition temperature, compared to other dental casting materials, and especially those materials which exhibit the necessary yield strengths for use in metallic dental prosthesis applications. Accordingly, bulk-solidifying amorphous alloys with glass transition temperatures lower than 400 °C., and most preferably lower than 300 °C. are preferred. For example, Zr--Ti base bulk-solidifying amorphous alloys have typical glass transition temperatures in the range of 320 °C. to 450 °C. depending on the alloy composition.

[0035] Applicants have discovered that these characteristics combined with the lack of any microstructure allow bulk-solidifying amorphous alloys to replicate the intricacies of the impressions in a dental casting with exceptional quality. The casting characteristics of bulk-solidifying amorphous alloys not only reduce the post-cast finishing processes, but also provide a better surface finish and preparation due to reduced or minimal defects arising from the initial casting operation. For example, a dental prosthesis constructed of a bulk-solidifying amorphous alloy can be given a very high polish and surface smoothness which helps to hinder bacteria growth in the mouth. Further, the high polish and other surface smoothness characteristics can be desirable from an aesthetic perspective as well.
(Specification, paragraphs 34 and 35.)

In contrast, Horton et al. is directed broadly to the use of bulk solidifying amorphous alloys in any sort of medical tool, device or implant. Nowhere do Horton et al. ever discuss the importance of, or suggest limiting the selection of an amorphous alloy to only those materials having the castability and surface replication properties discussed by Applicants. Indeed, Horton et al. only ever discuss three parameters as being of "importance" in choosing an amorphous material for their "medical devices":

hardness/toughness, elastic limit and magnetic or imaging properties. (See, e.g., Horton et al., paragraphs 30, 34, 36, 46, 47 and 48.) Applicants can find no discussion or teaching anywhere in the Horton et al. reference that even suggests that the amorphous material should be selected based on "castability" and "ability to replicate", as required by the claims of the instant invention. Moreover, where Horton et al. do discuss elastic limit it is only in the context of "matching" the elastic limit of the implant to the attached bone, not in maximizing the elastic limit to ensure that replicated features are more resistant to deformation. (See, Horton et al., paragraph 36.)

Nor are the differences between the amorphous materials called out by Horton et al., and those taught by the current invention surprising. As explicitly set forth in the amended claims, the current invention is directed to a "dental prosthesis" that "replicates" a portion of a tooth. As discussed by Applicants, such a prosthesis necessarily will be comprised of innumerable fine features. Moreover, as further described by the instant application it is essential to be able to accurately replicate these features in the prosthesis to ensure good fit and function. (Specification, paragraph 33.) In contrast, the only medical appliances taught by Horton et al. are standard pieces such as, for example, plates, screws, pins, joints, clips, etc. (See, e.g., Horton et al., Table 2 and paragraph 36.) Indeed, the only reference to any sort of "dental appliance" in the Horton et al. publication is to an "arch wire" in Table 2. Nowhere do Horton et al. ever describe or even suggest the use of these materials to "replicate" the fine surface features of a tooth, and as such the specific technical challenges presented by such an application of these amorphous materials is simply never addressed or even considered by the authors.

In short, while Horton et al. describe a set of properties (hardness, toughness, and elastic limit) that are important to the proper practice of Applicants' invention, these properties are not *sufficient* to fully practice Applicants' invention. Accordingly,

Applicants would respectfully submit that one of ordinary skill in the art, having read the entirety of the Horton et al. reference and its teaching of a broad category of useful amorphous materials, would have had no reason to restrict themselves to only those amorphous alloys that have both the hardness and elastic limit properties set forth by Horton et al., and the coefficient of thermal expansion and glass transition temperature properties taught by the instant application. In light of this deficiency, Applicants would submit that the claims of the instant application cannot be rendered obvious in view of the teachings of the Horton et al. reference.

The Lin et al. and WIPO References

As discussed above, Applicants do not believe the teachings provided by the Horton et al. reference in any way render unpatentable the claims of the current application. Nor do either the Lin et al. or the WIPO references address the fundamental deficiencies of the Horton et al. reference, namely that Horton et al. never teach, disclose or even suggest that amorphous materials should be selected based on their coefficient of thermal expansion and transition temperature properties as well as their hardness and elastic limit properties when being used to form dental prostheses.

Specifically, as indicated by the Examiner both Lin et al. and the WIPO publication are both directed to novel amorphous alloy compositions, not to dental devices. As such, neither of these references ever provides any discussion concerning which of the many materials disclosed within their pages would provide the improved dental prostheses claimed in the instant application. Accordingly Applicants would again respectfully submit that one of ordinary skill in the art, having read the entirety of the Horton et al. reference and the Lin et al. or WIPO references and their combined teachings of broad categories of useful amorphous materials, would have had no reason to restrict themselves to only those amorphous alloys that have both the hardness and elastic limit properties set forth by Horton et al., and the coefficient of

thermal expansion and glass transition temperature properties taught by the instant application. In light of this deficiency, Applicants would submit that the claims of the instant application cannot be rendered obvious in view of the teachings of the Horton et al. in view of either Lin et al. or the WIPO publication.

Obviousness-Type Double Patenting Rejections

The Examiner also rejected claims 1 to 20 over claims 1 to 22 of Applicants' copending U.S. Patent Application No. 10/524,954. Applicants will submit a terminal disclaimer upon receipt from the Examiner of an indication of allowable subject matter.

Conclusion

In view of the foregoing amendment and response, it is believed that the application is in condition for further examination. If any questions remain regarding the allowability of the application, Applicant would appreciate if the Examiner would advise the undersigned by telephone.

Respectfully submitted,

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JWP/t